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ICES CM 2005/ACFM:24

Report of the North Western Working Group

Sebastes mentella

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International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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Contents

1 Introduction

1.1 Participants

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1.2 ToR

The ToR that were addressed by the subgroup of the NWWG that constitute this report were:

a) assess the status of and provide catch options for 2005 for the stocks of redfish in Subareas V, XII and XIV, Greenland halibut in Subareas V and XIV, cod in Subarea XIV, NAFO Subarea 1, and Division Va, saithe in Division Va and haddock in Division Va;
b)
c)
d)
e) update information on the stock composition, distribution and migration of the redfish stocks in Subareas V and XIV, and consider the report of SGSIMUR with regard to implications for assessment and advice on pelagic "deep-sea" *Sebastes mentella* and the *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope;
f) provide information on the horizontal and vertical distribution of pelagic redfish stock components in the Irminger Sea as well as seasonal and interannual changes in distribution;
g) provide specific information on possible deficiencies in the 2004 assessments including, at least, any major inadequacies in the data on catches, effort or discards; any major inadequacies in research vessel surveys data, and any major difficulties in model formulation, including inadequacies in available software. The consequences of these deficiencies for the assessment of the status of the stocks and for the projection should be clarified;
h) comment on this meeting's assessments compared to the last assessment of the same stock, for stocks for which a full or update assessment is presented;

In addition to the ToR from ICES the NWWG is asked to address the NEAFC request to ICES on the following issues: "**Regarding redfish** stocks: a) submit new information on stock identity of the components of redfish such as "pelagic deep-sea" Sebastes mentella, "oceanic" Sebastes mentella fished in the pelagic fisheries and the "deep-sea" Sebastes mentella fished in demersal fisheries on the continental shelf and slope. NEAFC requests ICES to include in its advice all relevant information, including the outcome of the ICES Study Group on Stock Identity and Management Units of Redfishes, planned in August 2004;"

1.3 Report structure

Since the SGSIMUR meeting was scheduled to occur after the NWWG spring meeting the NWWG ToR that related to the stock structure of S. mentella and stock status were posponed. The focus of the spring meeting was on answering questions related to description of catch and the fishery as well as present information, such as the survey biomass estimates in 2003, that would not likely change in relation to likely outcome of SGSIMUR. Although at the cost of some confusion it was decided not to update the spring report but provide a separate summary of the current meeting.

In light of the conclusion of SGSIMUR the treatment by the NWWWG of the demersal S. mentella as a separate management unit was the same as has been done in the past. Thus any reference to S. mentella stock status that is provided in this report (section 4.1) relates to informations provided in chapter 9 of the spring report. Reference to

oceanic stock status, weather delt with as two management unit (section 4.2 and 4.3) or as one management unit (section 4.4) relate to chapter 10 of the spring report. Issues related to management units, stock units, etc. in this report relate to section 7 and to some extent to section 10 in the spring report.

Note that figures 9.2.5 - 9.2.7 are in the wrong place, should be in chapter 7.

2 Stock Structure and Management

2.1 The SGSIMUR report

2.1.1 Background

NWWG stated in 2003 that it was primarily an assessment group and as such did not have the sufficient expertise to thoroughly review the scientific research of redfish stock identification as had been requested in ToR for that year. In light of this and in light of the commencement of the EU project on redfish ICES set up a specific study group (SGSIMUR) to "identify the most likely definition of biological stocks of S. mentella as well as suggest practical management units" (SGSIMUR ToRb).

2.1.2 The SGSIMUR conclusion

The principal conclusion in the SGSIMUR report are:

Observed structure: There was a consensus in SGSIMUR about the existence of some or another kind of structure of the S. mentella resources in the Irminger Sea and adjacent waters, although there was not a consensus on the cause of the observed structure .

Biological stock and management units: The prevalent number of researchers that participated in the SGSIMUR meeting concluded " .... that the S. mentella in the Irminger sea and adjacent waters, based on current available knowledge, should be considered as three separate stocks and managed accordingly. These stocks are:

- Oceanic Sebastes *mentella*
- Pelagic deep-sea *S. mentella*
- Demersal S. *mentella*"

Some scientific researcher provided a separated opinion that S. mentella was one biological stock and suggested, in light of that, that the current management units where kept (2 management units, one for demersial S. mentella, one for pelagic S. mentella).

SGSIMUR members that propesed three practical management units stated that they should be based on geographical areas and season. NWWG is of the opinion is that, given the current pattern in the fisheries, area based management is sufficient and that there is no reason to base management on seasonal criteria at present. Although it is not expected that the area of fishing will overlap in the short term it cannot be excluded that that former distribution of the S. mentella may occur. Future management measures may need to take this into account.

The SGSIMUR suggested that the current line separating the management of pelagic deep-sea S. mentella and demersal S. mentealla in Icelandic waters should kept. No specific coordinates where given for the separation of the oceanic S. mentella and pelagic deep-sea S. mentella were provided by SGSIMUR. The NWWG proposes that the coordinates given in Table 1 and shown in Figure 1 should be considered as areal based management units of these two components.

2.1.3 Implication of the SGSIMUR conclusions

The SGSIMUR conclusions were discussed within the NWWG in relation to ToRe) "....consider the report of SGSIMUR with regard to implications for assessment and advice on pelagic "deep-sea" Sebastes mentella and the Sebastes mentella fished in demersal fisheries on the continental shelf and slope." Since the SGSIMUR report does not contain a unanimous consensus on proposed management units, and since there is not a consensus within the NWWG, this report provide text on the state of the stock as:

- 1 management unit for the dermesial S. mentella (section 4.1)

and

- management units for pelagic S. mentella (section 4.2 and section 4.3)

or

- 1 management unit for pelagic S. mentella (section 4.4)

In practical terms the NWWG thus dealt with the issue on the basis that the scientific debate of the likely stock structure of Sebastes mentella in the Irminger Sea and adjacent waters is not closed.

2.2 Definition of management units in light of the precautionary approach

The issue of management advice in relation to precautionary approach has been a recurrent theme of discussion within the NWWG. The conclusion of that debate has been possponed in recent years in light of ongoing research on the stock structure of S. mentella. In light of conclusion of the SGSIMUR the working group reopened the issue, although it is noted that it is not an official ToR for the NWWG to evaluate definition of management units in light of the precautionary approach.

It was noted by the NWWG that the recommendation by the prevalent members [majority] of SGSIMUR to manage the S. mentella as 3 units was justified in relation biology, caution, conservation and the precautionary approach.

The NWWG notes that the basis of 1 management unit of the pelagic S. mentella, as proposed by Russian researchers within SGSIMUR, makes no reference to the precautionary approach. It is also noted that recommended postponement of management decision in light of the uncertainty goes counter to the precautionary approach.

These questions of management units were further discussed by the NWWG in a qualitative sense in relation to exploitation rate and biological diversity. Since other elements than biomass or density may be more important in determining exploitation rate of the fishing fleet, it was concluded that fishery on the S. mentella under a 1 management regime would more likely lead to overexploitation of any single element than if the S. mentella were managed as 3 separated entities. Since overexploitation may lead to depletion it was concluded that a 1 management regime would more likely lead to decrease in biological diversity than a 3 unit regime.

The ICES advice is by and large based on the precautionary approach. The NWWG is of the opinion that ICES decision when proposing management units should be made on the basis of the precautionary approach. Given the reasons above the suggested 3 practical management units proposed by SGSIMUR is most likely to conform with the precautionary approach.

3 Catches and Fisheries of Proposed Management Units

Trends in landings by the pelagic stocks

Assuming that the pelagic S. mentella in the Irminger Sea and adjacent waters are two different stocks, i.e. oceanic and pelagic deep-sea S. mentella, an attempt has been made in order to separate the landings into these two stocks.

For the period 1982-1991, all landings are from the oceanic S. mentella because the main fishing area was in the central Irminger Sea from 58° to 61°N and between 28° and 36°W, the NEAFC Regulatory Area beyond Greenland and Icelandic national jurisdictions at depths between 75 and 400 m.

In the period 1992-1996, the fishery gradually shifted towards trawling at greater depths and developing a clear seasonal pattern in the fishery. Both the fishing areas and the depth of trawling changed systematically as the season progressed. By the end of this period, all fleets were fishing in the NE part of the Irminger Sea on the pelagic deep sea S. mentella in the beginning of the season until around mid June, when all fleets moved southwest to the central Irminger Sea to fish on the Oceanic S. mentella. For this period, landings have been assigned to stocks based on different criteria such as landings by ICES statistical areas, landings by nation, logbook data and the knowledge (feelings) on the fishery by the WG members. The landing figures by stock for this period are therefore to be regarded as the WG's best estimates (guestimates).

From 1997 onwards, following persistent fishing pattern have developed: During the first months of the fishing season (April), the fishery is conducted in an area east of 32°W and north of 61°N. In May and June, the fishery is conducted more or less at the same areas, but in July and August, the fleets moved to areas south of 60°N and west of about 32°W, where the fishery continues until October. There are very little fishing activities in the period from November until late March or early April when the next fishing season starts. For the period from 1997 onwards, logbook data from Russia, Iceland, Faroe Islands, Norway and Germany have been used to calculate landings by stock. Based on the fishing areas since 1997, two areas have been defined separating the two stocks, and by summing up the data within this areas, the catches of the mentioned nations can be obtained. This method should be semi-indipendent from the one described in table 10.1.3 in the report of the NWWG from May. Catches by other nations are assumed based on the same proportions as calculated here.

The results are given in Tables 2 and 3 and in Fig. 3.

4 State of Stock

4.1 Demersal S. mentella

Scientific measurements

The fishable biomass index of *S. mentella* in Va from the Icelandic autumn survey 2000-2003 shows an increase in the index between 2000 and 2001, but since then there has been a considerable decrease. The biomass index measured in 2003 is the lowest measured (Figure 4). Because there may be a high variance in the estimates and because the time series of the survey is short, it may be difficult use such data to explain any trend in the biomass.

The survey abundance index for shelf *S. mentella* in Vb from the Faeroes summer survey shows up to a five-fold decrease from 1996 to 2003 (Figure 9.2.3 in ICES CM 2004/ACFM:25).

The survey on the continental shelf in area XIV show that commercial sized deep-sea S. mentella (>30 cm) are currently severely depleted compared with measurements in the mid 1980's (Figure 9.2.5 in ICES CM 2004/ACFM:25).

Information from the fishery

CPUE indices from the bottom trawl fishery in Division Va decreased considerably from highs in the late 1980s to the middle of the 1990s, when it went close to 50% of the maximum (Figure 9.2.1 and Table 9.2.1 in ICES CM 2004/ACFM:25). Since then, the CPUE has increased slightly and continued to increase between 2002 and 2003.

In Division Vb, the development in the CPUE from the commercial bottom trawlers resembles that in Division Va, i.e., the CPUE seems to have stabilised at below 50% of the maximum in the time series (Figure 9.2.2 in ICES CM 2004/ACFM:25). There was an increase in CPUE in 2002 compared to the year before, but decreased again in 2003 to a similar level as it was in 2001.

Conclusion

The CPUE indices have been used as the basis for advice of shelf S. mentella. The indices indicate that the stock is showing a slow recovery after a substantial decline in the mid 1990s. Information from the surveys indicate that the stock has decreased in recent years and the total allowable catch was not taken in the last quota year. That is in contradiction with the conclusion derived from the CPUE indices. These factors should be taken into account when an advise for TAC is given.

4.2 Pelagic deep-sea S. mentella

Scientific measurements

Available survey trawl estimates are given in Table 10.2.1 in the spring report Given the high variability in the correlation between trawl and accustic estimates as well as the assumptions that need to be made about constant catchability with depth and across stocks the uncertainty of these estimates are very high and should be treated with care.

The trawl estimate includes only three measurements covering the period from 1999 to 2003. They are thus too short use be used to describe any trends in stock size. The variability in the estimates (1999=638 thous. tonnes, in 2001 =1057 and in 2003 =678) could be an indicator of the precision of the survey..

The estimated catches of pelagic deep-sea S. mentella in 1999, 2001 and 2003 were 77, 90 and 113 thousand tonnes. If the trawl estimate are assumed to be an estimator of true absolute biomass the average exploitation rate in the three years is approximately 14%.

Information from the fishery

It is not known to what extent CPUE reflect change in stock status of deep sea S. mentella. The fishery is focusing on schooling aggregations. Therefore CPUE series might not indicate or reflect actual trends in stock size. Until the relationship between stock size and fishing success for deep-sea S. mentella is know, these indices should thus be treated as biased, i.e. as too optimistic, if they are to be used as a basis for assessment and advice.

During the last years there has been consistent pattern in the fishery in terms of seasons (April - July) and geographical area. For most of the fishing fleet (countries) the CPUE indices from 1997 to 2003 are stable. The increase in the Icelandic CPUE series show that observed increase from 2001-2003 has now reversed and the 2004 value is about 40% lower than the value in 2003. The Spanish data show a 24% reduction in 2004 compared with 2003 and both series are comparable with the value in 2001 (figure 2).

Conclusion

Based on the data available, the status of the pelagic deep-sea S. mentella must be considered as highly uncertain. Exploitation rate may be above the suggested 5% exploitation rate.

4.3 Oceanic S. mentella

Biomass estimates are available from both surveys and commercial fisheries (CPUE) but there are considerable doubts about their usefulness as indicators of stock sizes.

Scientific measurements

Despite the ever increasing area coverage in the accustic surveys the biomass estimators are consistently lower in consequtive measurements (Table 10.2.1). The WG's best estimate of the yield removed by the fishery cannot explain the decline in the measured biomass during this period. In the 2001 survey it was concluded that the surveyed area did not cover the whole distribution area of the stock since high values were measured on the border of the survey area. In the 2003 survey high values at the boarder of the survey area were not observed. The timing of the 2003 survey was not exactly the same as in previous years. The biomass estimate in 2003 was only 12% of that measured in 2001. There is no clear explanation available to account for this large reduction.

Acoustic biomass estimates were relatively stable during 1991 to 1995, but they have declined substantially, from 2.48 million tonnes in 1995 to 0.09 million tonnes in 2003. The acoustically estimated biomass in 2003 is approximately 5% of the estimate in early nineties.

The average catches of oceanic S. mentella in 1999-2003 are 31 thousand tonnes. If the trawl estimate are assumed to be an estimator of true absolute biomass, taking the average biomass estimates from the last three survey and the average catch over 1999-2003 imply that the exploitation rate is 7%. For 1999 and 2001 the exploitation rate is 5%, but 40% for 2003.

Information from the fisheries

It is not known to what extent CPUE reflect change in stock status of deep sea S. mentella. The fishery is focusing on schooling aggregations and has been changing, both seasonally and geographically. Therefore CPUE series might not indicate or reflect actual trends in stock size. Until the relationship between stock size and fishing success for deep-sea S. mentella is know, these indices should thus be treated as biased, i.e. as too optimistic, if they are to be used as a basis for assessment and advice.

Although varying, the available commercial CPUE series has remained stable since 1995 (in Figs. 10.2.3a and 10.2.4 of the May report of the NWWG).

Conclusion

Based on the available data, the status of the oceanic S. mentella must be considered as highly uncertain. The accustic biomass estimate in 2003 is the lowest on record. Taking into account the uncertainty in stock indicators, it is not known what the exploitation rate generated by recent catches is in relation to the 5% exploitation rate which has been suggested suitable for such a long lived species.

4.4 Pelagic S. mentella (combined pelagic deep-sea and oceanic S. mentella)

Scientific measurements

Despite the ever increasing area and depth coverage in the accustic and trawl surveys the biomass estimators are consistently lower in consequtive measurements (Table 10.2.1). The WG's best estimate of the yield removed by the fishery cannot explain the decline in the measured biomass during this period. In the 2001 survey it was concluded that the surveyed area did not cover the whole distribution area of the stock since high values were measured on the border of the survey area. In the 2003 survey high values at the boarder of the survey area were not observed. The timing of the 2003 survey was not exactly the same as in previous years. The biomass estimate in 2003 was only 43% of that measured in 2001. There is no clear explanation available to account for this large reduction.

Acoustic biomass estimates were relatively stable during 1991 to 1995, but they have declined substantially, from 2.48 million tonnes in 1995 to 0.09 million tonnes in 2003. The acoustically estimated biomass in 2003 is approximately 5% of the estimate in early nineties. Adding the trawl biomass estimate below 500m to the accustic estimates imply that the biomass in 2003 is 0.8 million tonnes. Given the high variability in the correlation between trawl and accustic estimates as well as the assumptions that need to be made about constant catchability with depth the uncertainty of these estimates are very high and should be treated with care.

The average catches of pelagic S. mentella in 1999-2003 are 129 thousand tonnes. If the biomass estimate are assumed to be an estimator of true absolute biomass, taking the average biomass estimates from the last three survey

and the average catch over 1999-2003 imply that the exploitation rate is 11%. The exploitation rate is 10%, 7% and 19% for 1999, 2001 and 2003

Information from the fisheries

It is not known to what extent CPUE reflect change in stock status of pelagic S. mentella. The fishery is focusing on schooling aggregations. Therefore CPUE series might not indicate or reflect actual trends in stock size. Until the relationship between stock size and fishing success for pelagic S. mentella is know, these indices should thus be treated as biased, i.e. as too optimistic, if they are to be used as a basis for assessment and advice.

Although varying, the available commercial CPUE series has remained stable since 1995.

Conclusion

Based on the available data, the status of the pelagic S. mentella must be considered as highly uncertain. The accustic biomass estimate and the combined accustic and trawl estimator in 2003 are the lowest on record. Exploitation rate may be above the suggested 5% exploitation rate which has been suggested suitable for such a long lived species.

5 Management Consideration

5.1 Management system

There is not a single agreed management regime for the pelagic S. mentella in the Irminger Sea.

Deep sea S. mentella: The WG discussed the problems of using CPUE data from schooling aggregations as an indicator of stock size. The pelagic deep-sea fishery is geographically on a very small area and hydrographical information form surveys a show that those areas are connected with areas of eddies and irregularities in the current systems. The group discussed the reliability of such data in connection with past experience with other species such as Atlanto-Scandian herring fishery in late 1960's.

5.2 Protection of nursery area

The abundance records of juvenile *S. mentella* on the Greenland shelf in 2003 are the second highest since 1985, indicating recruiting year classes. These juveniles observed at East and West Greenland will probably recruit to both the demersal stock on the shelves of Greenland, Iceland and Faeroes Islands, and to the open sea of Irminger Sea (both the oceanic *S. mentella* and pelagic deep-sea *S. mentella*), but to what extent to each of them is still unknown.

The strong recruiting cohort(s) observed in 1993-97 emigrated from East-Greenland in 1998-2000 and have been documented to have recruited to all three stocks (ICES CM 2004/ACFM:25, Stransky 2000, SGSIMUR 2004). Before migrating away from the Greenland shelf and recruiting to the surrounding areas, including the pelagic stocks, substantial quantities of these cohort(s) (immature fish less than 30 cm) were caught in a demersal commercial fishery on the Greenland shelf (Table 9.1.1, Figure 9.1.7).

Adult sized demersal *S. mentella* on the Greenland shelf may be found in the same area as the main nursery area for all three *S. mentella* stocks in the Irminger Sea and adjacent waters. The German survey on the continental shelf in area XIV show, however, that adult sized shelf deep-sea *S. mentella* (>30 cm) on the Greenland shelf are currently severely depleted compared with measurements in the mid 1980's. To ensure a recovery of the adult S. mentella in Greenland it is recommended that the area should be closed to fishing. This would also provide a maximum protection and survival of juveniles S. mentella. Once the recovery of the adult size fish in the area has been established measure that allow for escapement of juveniles should take into consideration likely effect of mortality related to the fishing activity.

6 Comparison with last years assessment

6.1 Demersal S. mentella

The state of the demersal S. mentella (section 4.1) has in the past been evaluated using commercial CPUE indices only. This year the Icelandic annual fall bottom trawl survey indices from 2000-2004 were also taken into consideration in a qualitative sense.

6.2 Pelagic S. mentella

The state of the pelagic S. mentella has in the past been evaluated based on the information from the scientific surveys in the Irminger sea as well as the commercial CPUE indices. The status of the stock, both in terms of stock structure as well as in terms of biomass, has been considered highly uncertain. In last two assessments the WG has concluded that the low 2001 survey estimate may be too pessimistic. In the absence of any other information ACFM has in the last two years based its advice on TAC on stability of the commercial CPUE indices.

In addition to the information used in previous years the WG evaluated the state in relation to the conclusion of the prevalent members of SGSIMUR that the pelagic S. mentella are two biological stocks. The working group still concludes that the state of both the oceanic and the deep-sea pelagic S. mentella biomass is highly uncertain. Although the record low 2003 survey measurements were questioned the WG considers that the survey measurements can not be ignored when advice on TAC is given.

7 Environmental conditions

7.1 Water masses shallower than 500 m

Strong positive anomalies of temperature observed in the upper layer of the Irminger Sea with a maximum in 1998, are related to an overall warming of water Irminger Sea and adjacent areas in 1994-2003. These changes were also observed in the Irminger Current above Reykjanes Ridge (Pedchenko, 2001), off Iceland (Malmberg *et al.*, 2001; Malmberg and Valdimarsson, 2001) and in the Labrador Sea water (Mortensen and Valdimarsson, 1999). Thus an increase in temperature and salinity has been found in the Irminger Current since 1997 to higher values than for decades, as well as a withdrawal of the Labrador Sea water due to a slow-down of its formation by winter convection since the extreme year 1988 (ICES WGOH STATUS REPORT 2001).

In May-June 2003 a continuing warming-up of the 0-200m layer was discovered, mainly northern part of the Irminger Sea around Irminger Current. At the same time decreasing temperature is observed in the southwest and spreading LCW and LSW in up 200-meters layers was recorded due to southern shift border of NACW.

At depts between 200 and 500 m, a positive anomalies on the most part of the observation area was observed, but increasing temperature as compared to last survey in June-July 2001 was obtained only north of 60° N in flow Irminger Current above Reykjanes Ridge and northwestern part sea. Within the known spawning areas of redfish near Reykjanes Ridge, decreasing temperature on depth below 400 m was observed.

These changes of oceanographic condition might have an effect on the seasonal distribution of redfish, place and period of spawning, direction and time of feeding migration and as a result peculiarities of redfish aggregations.

7.2 Water masses deeper than 500 m

Deeper than 500 m a positive anomalies on the most part of the observation area was observed, but increasing temperature as compared to last survey in June-July 2001 was obtained only north of 60° N in flow Irminger Current above Reykjanes Ridge and northwestern part sea. Within the known spawning areas of redfish near Reykjanes Ridge, decreasing temperature on depth below 400 m was observed.

8 Recommendation

The NWWG meeting in 2005 should reevaluate the age-based model that was the foundation of the 5% exploitation proxy in 1995,. taking into account recent knowlegde.

Set up a study group to evaluation of the survey design and past survey informations (see NWWG 2003 report). The study group should consider the feasability of making accustic measurement during the period when commercial fishery takes place on S. mentella aggregations. The objective of such a measurement would be to provide a qualitative indicator of the accuracy of the accustic biomass estimates.

The recommendation in the SGSIMUR report are supported by the NWWG.

The NWWG reiterates that its is primarily composed of experts in stock assessment and as such does not have the sufficient expertise to thoroughly review the scientific research of redfish stock identification. Any ToR that are related to such topics should thus be dealt with in a separate study group.

Table 1. Suggested coordinates for the proposed management units of pelagic deep sea and oceanic S. mentella.

Pelagic	deep-sea	
	lat	lon
1	64°45	-28°30
2	62°50	-25°45
3	61°55	-26°45
4	61°00	-26°30
5	59°00	-30°00
6	59°00	-34°00
7	61°30	-34°00
8	62°50	-36°00
9	64°45	-28°30
Oceanic		
	la	lon
1	62°50	-36°00
2	61°30	-34°00
3	59°00	-34°00
4	59°00	-26°00
5	49°15	-36°00
6	49°15	-50°00
7	52°15	-51°00
8	55°20	-54°00
9	57°40	-59°00
10	60°45	-61°00
11	60°45	-42°00
12	62°50	-40°00
13	62°50	-36°00

Table 2. Estimated catch of pelagic S. mentella.

Table 3.x.	Total catch pelagic oceanicS.mentella (t).							
Year	Faroes	Germany	Iceland	Norway	Russia	Greenland	Others*	Total
1980	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0
1982	0	0	0	0	60000	0	581	60581
1983	0	155	0	0	60079	0	0	60234
1984	0	989	0	0	60643	0	3200	64832
1985	0	5438	0	0	60273	0	5960	71671
1986	5	8574	0	0	84994	0	11534	105107
1987	382	7023	0	0	71469	0	12295	91169
1988	1090	16848	0	0	65026	0	8455	91419
1989	226	6797	3816	0	22720	567	4658	38784
1990	0	7957	4537	7085	9632	0	2690	31901
1991	115	571	8783	6197	9747	0	2195	27608
1992	3765	6447	13930	14654	15733	9	9876	64414
1993	7121	17813	18326	14990	25229	710	27065	111254
1994	0	17152	37332	7357	17814	0	50138	129793
1995	0	11576	25186	5220	30927	1856	63492	138257
1996	0	14673	29182	2737	18299	3537	33776	102204
1997	0	12256	2336	1761	6482	0	3968	26803
1998	1361	11049	1569	1139	8034	47	3646	26845
1999	1275	8382	5398	4936	7460	525	4831	32807
2000	459	5606	656	1718	10727	61	5354	24581
2001	4179	5330	14026	1042	4762	1093	8666	39098
2002	374	5341	5362	1250	12188	494	6478	31487
2003	1477	3599	4881	3358	15127	449	7116	36007
1980-1991	All pelagic catches assumed to be of oceanic S. mentella							
1992-1996	Guestimates based on different sources (see text)							
1997-2003	Catches from calculations based on the joint catch database and total landings							

Table 3. Estimated catch of pelagic deep sea S. mentella.

Table 3.y. Total catch pelagic deep sea S.mentella (t).								
Year	Faroes	Germany	Iceland	Norway	Russia	Greenland	Others*	Total
1980	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0
1992	0	0	1548	0	0	0	0	1548
1993	0	0	4582	0	0	0	0	4582
1994	2896	0	16000	0	0	0	0	18896
1995	5239	7409	9445	2237	13255	0	0	37585
1996	6271	6572	33721	4105	27449	0	0	78118
1997	3945	8220	38940	1418	30448	0	13161	96132
1998	6113	6998	46950	0	17803	1416	10843	90123
1999	3381	8107	38525	499	10497	3744	12105	76858
2000	2378	6893	44576	3476	18497	4143	21532	101495
2001	3802	5339	28446	4180	25250	2216	20507	89740
2002	3872	7871	39130	4041	24031	3605	20733	103283
2003	2958	7009	43517	4826	28929	4001	22192	113432
1980-1991	All pelagic catches assumed to be of oceanic S. mentella							
1992-1996	Guestimates based on different sources (see text)							
1997-2003	Catches from calculations based on the joint catch database and total landings							

Table 4. Survey biomass, catch and proxy for exploitation rate for oceanic S. mentella

Year	Biomass (t) Survey<500m	Commercial catches <500m (t)	Exploitation rate (%)
1991	2235000	27608	1
1992	2165000	64414	3
1993	2556000	111254	4
1994	2190000	129793	6
1995	2481000	138257	6
1996	1576000	102204	6
1997	1225000	26803	2
1998		26845	
1999	614000	32807	5
2000		24581	
2001	716000	39098	5
2002		31487	
2003	89000	36007	40
Mean (91-03)	1584700	60858	8
Mean (91-95)	2325400	94265	4
Mean (99-03)	473000	31090	17

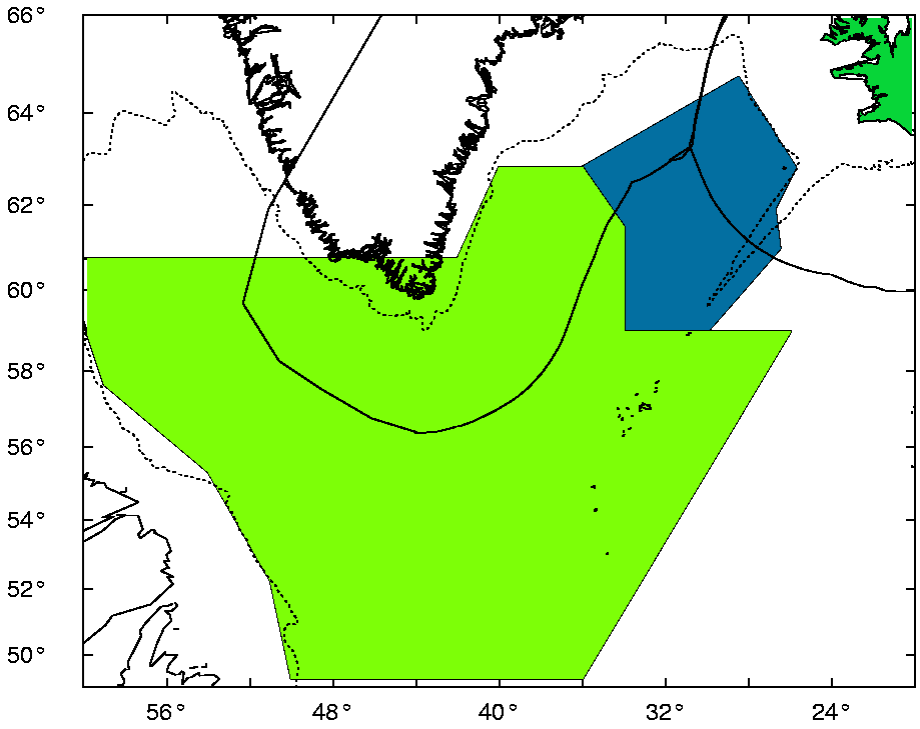

Figure 1. Proposed management areas for oceanic S. mentella (green) and pelagic deep sea S. mentella (blue).

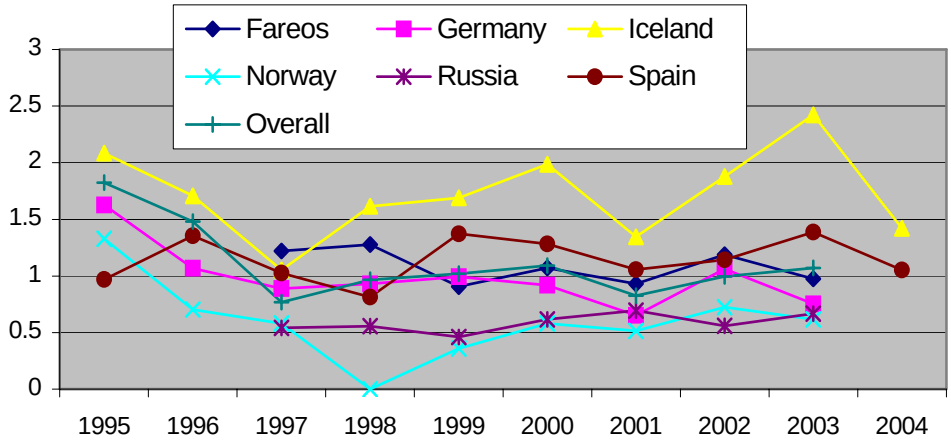

Figure 2. Catch per unit effort of the fisheries of oceanic S. mentella.

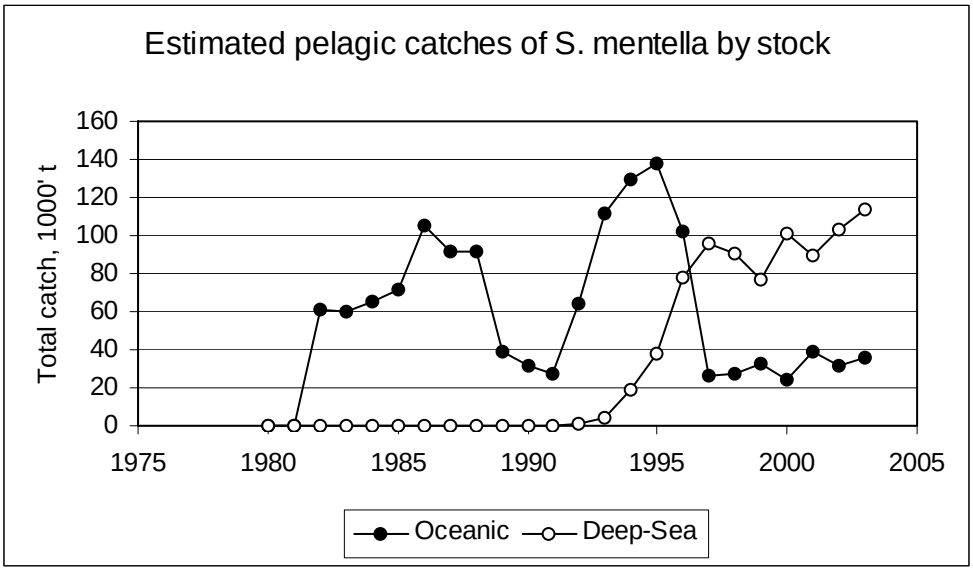

Figure 3. Estimated catch of the oceanic and the pelagic deep sea mentella.

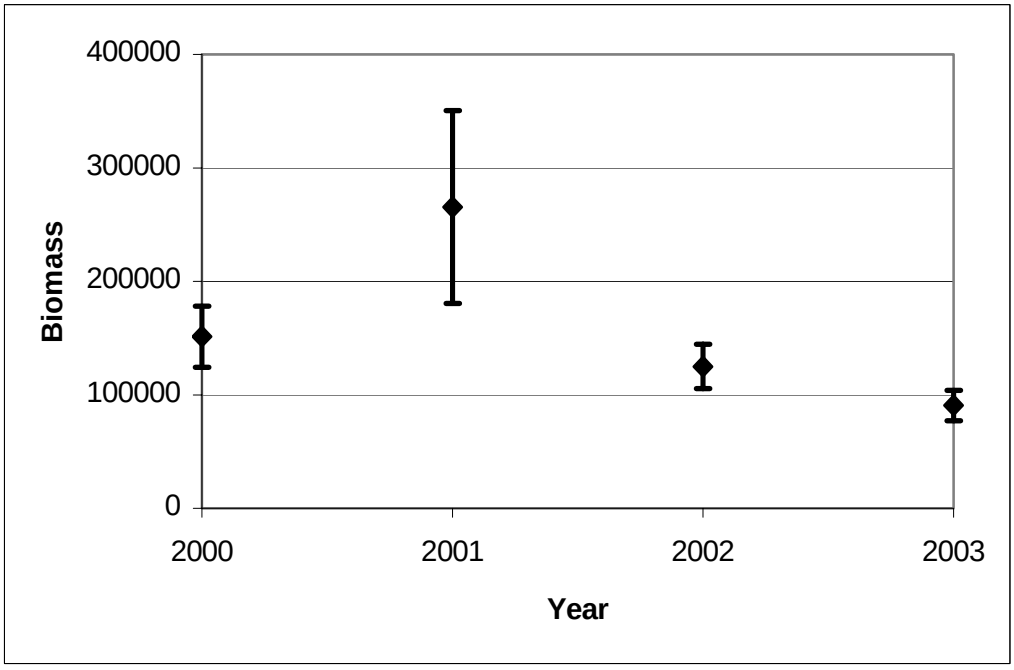

Figure 4 Total biomass index of the Icelandic shelf deep-sea *S. mentella* in the autumn survey conducted in Division Va 2000-2003.